

Influence of silicon dioxide nanoparticles on dielectric relaxation of triglycine sulfate

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This study is devoted to clarifying the nature of anomalous phase transition and dielectric relaxation properties of a classical ferroelectric triglycine sulfate (TGS) under the influence of silicon dioxide nanoparticles (SiO_2) at low frequencies of 10^2 - 10^7 Hz in a temperature range from 20 to 120 °C. Although the composite from SiO_2 and TGS has been synthesized already as reported in [1,2], there are several aspects needed to mention: (i) the influence of SiO_2 at different composition weight ratios on properties of TGS was not studied; (ii) the features of dielectric relaxation that plays a leading role for TGS applications at low frequencies were not considered at all. To fill this gap, a composite from silicon dioxide nanoparticles (SiO_2) and triglycine sulfate (TGS) was synthesized at different SiO_2 :TGS weight ratios. X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR) techniques were utilized to characterize the synthesized composite samples before utilizing them for dielectric measurements (Fig. 1).

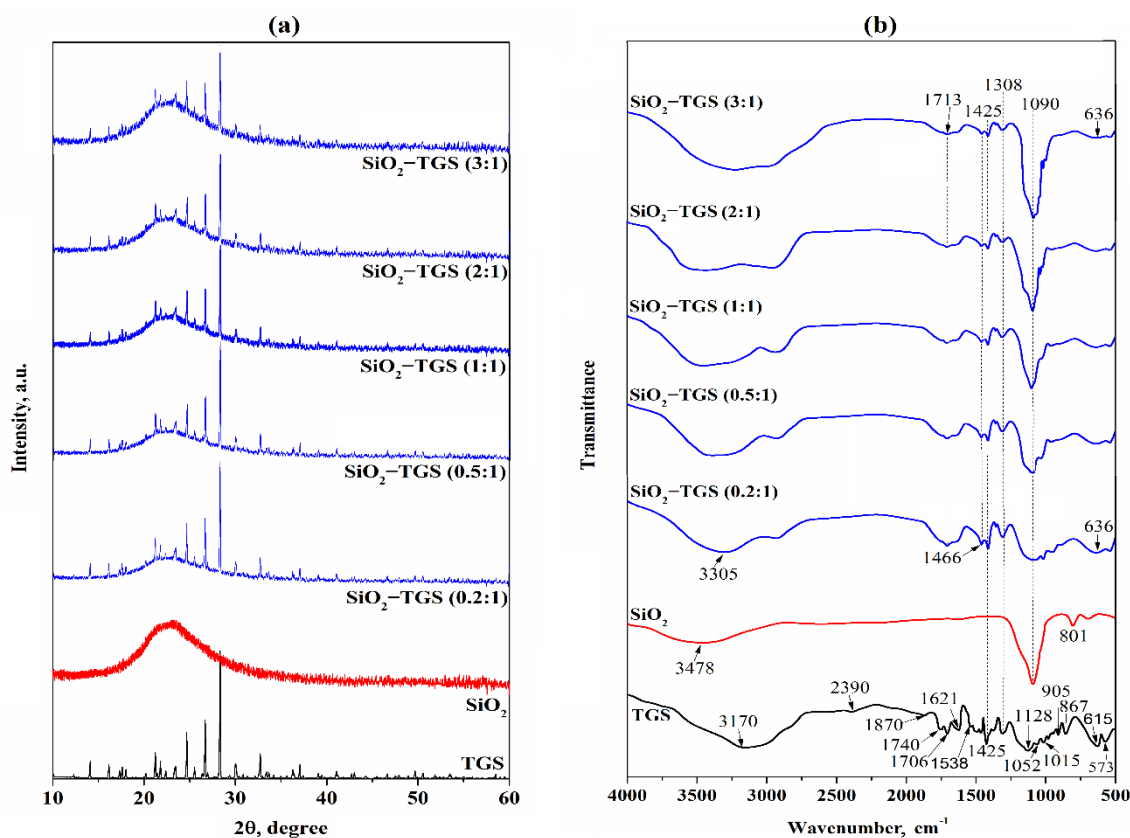


Figure 1. XRD patterns (a) and FTIR spectra (b) for TGS, SiO_2 and for SiO_2 +TGS composite at different composition weight ratios.

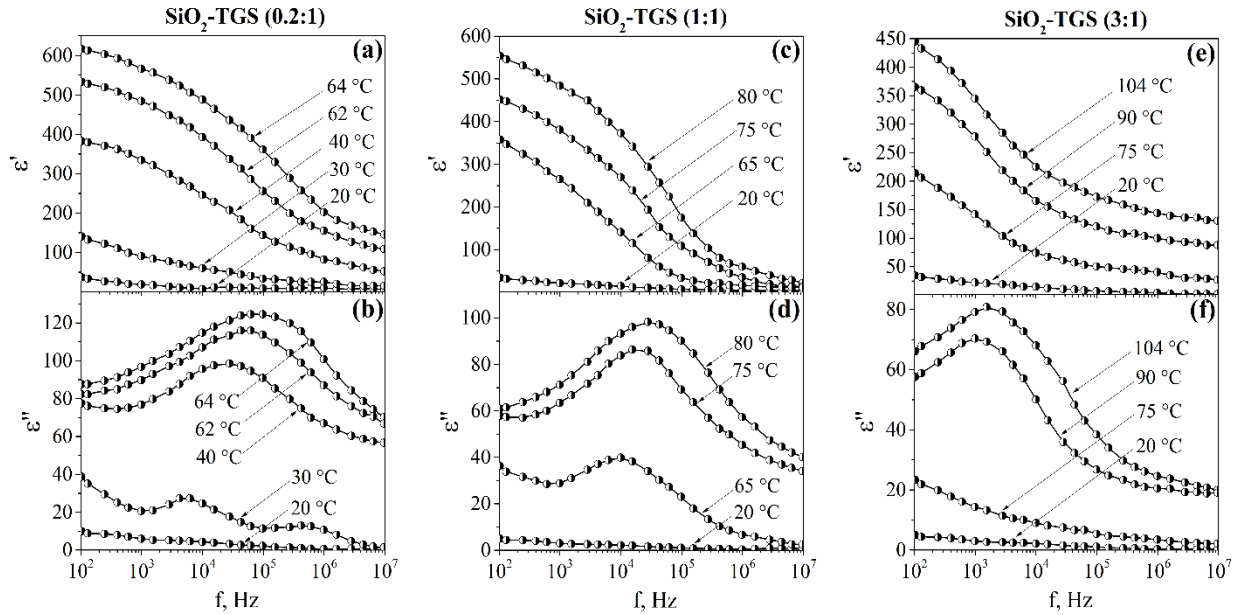


Figure 2. Frequency dependences of the real and imaginary parts of complex dielectric constant for SiO_2+TGS composite at $\text{SiO}_2:\text{TGS}$ weight ratios of 0.2:1 (a, b), 1:1 (c, d) and 3:1 (e, f) at different temperatures in ferroelectric phase.

It was indicated that the relaxation frequencies decreased with increasing SiO_2 content (Fig. 2). In addition, in comparison with Curie point of single crystals TGS, the phase transition temperature in TGS component increased from 15 to 55 °C. The obtained anomalies were thoroughly explained based on the assumption of interaction occurred between composite components through hydrogen bonds.

1. S.D. Milovidova, O.V. Rogazinskaya, A.S. Sidorkin, et al. *Phys. Solid State* **57**, 510 (2015).
2. S.D. Milovidova, O.V. Rogazinskaya, A.S. Sidorkin, et al. *Bull. Russ. Acad. Sci.: Phys.* **74**, 1295 (2010).